CLAIMS

1. A system for the generation of electrical energy, comprising:

a fuel cell stack comprising at least one fuel cell operable to generate electrical energy;

at least a first compressor coupled and operable to supply an oxidant flow to the fuel cell; and

a drive unit comprising at least two permanent-magnet electric motors each comprising a respective set of stator windings and both electric motors sharing a common rotor, the common rotor mechanically coupled to drive the first compressor.

2. The system of claim 1, further comprising:

at least one electrical storage device electrically couplable to supply power to at least one of the electric motors.

3. The system of claim 2 wherein the at least one electrical storage device comprises a battery.

4. The system of claim 1 wherein the sets of stator windings of the electric motors are arranged concentrically with respect to one another.

5. The system of claim 4 further comprising:

a first voltage converter electrically coupled to supply a first voltage to a first one of the electric motors; and

a second voltage converter electrically coupled to supply a second voltage a second one of the electric motors.

6. The system of claim 1 wherein one of the sets of stator windings is a high-voltage stator winding and the other one of the sets of stator windings is a low-voltage winding.

7. The system of claim 6 further comprising:

a first voltage converter electrically coupled to supply a first voltage to a first one of the electric motors; and

a second voltage converter electrically coupled to supply a second voltage a second one of the electric motors.

8. The system of claim 7 wherein one of the stator windings is a high-voltage stator winding and the other one of the stator windings is a low-voltage stator winding.

9. The system of claim 8 wherein the high-voltage stator winding is positioned concentrically inside of the low-voltage stator winding.

10. A method of operating a system for the generation of electrical energy, the method comprising:

supplying a low voltage from an electrical storage device to a first permanent-magnetic electric motor during a startup period;

turning a rotor common to both the first and a second permanent-magnetic electric motor in response to the supply of the low voltage to the first permanent-magnetic electric motor during the startup period;

driving a compressor mechanically coupled to the rotor to supply an oxidant to a fuel cell stack during the startup period;

supplying a high voltage from the fuel cell stack to the second permanent-magnetic electric motor in response to the supply of oxidant, during an operation period;

turning the rotor in response to the supply of the high voltage to the second permanent-magnet electric motor during the operation period; and

driving the compressor mechanically coupled to the rotor to supply the oxidant to the fuel cell during the operation period.

11. The method of claim 10, further comprising:

supplying power from the fuel cell stack to a traction motor during at least a portion of the operation period.

12. The method of claim 10, further comprising:

supplying power from the fuel cell stack to a traction motor during at least a portion of the operation period; and

supplying power from the fuel cell stack to a water pump during at least a portion of the operation period.

13. The method of claim 10, further comprising:

supplying power from the fuel cell stack to a traction motor during at least a portion of the operation period; and

supplying power from the fuel cell stack to a high pressure compressor during at least a portion of the operation period.

14. The method of claim 10, further comprising:

supplying a recharging current to the electrical storage device from the fuel cell stack during at least a portion of the operation period.

15. The method of claim 10, further comprising:

converting the low voltage supplied from the electrical storage device to the first permanent-magnetic electric motor during the startup period based on a desired speed of the compressor.

16. The method of claim 10, further comprising:

converting the high voltage supplied from the fuel cell stack to the second permanent-magnetic electric motor based on at least one operating conditions of the fuel cell stack.

17. A system for the generation of electrical energy, the system comprising:

low voltage means for driving a compressor to supply an oxidant flow to a fuel cell stack in response to a low voltage supplied from an electrical storage device during a startup period;

high voltage means for driving the compressor to supply the oxidant flow to the fuel cell stack in response to a high voltage supplied from the fuel cell stack during an operational period.

18. The system of claim 17 wherein the low voltage means comprises:

a first permanent-magnetic electric motor comprising a first set of stator windings and a common rotor.

19. The system of claim 18 wherein the high voltage means comprises:

a second permanent-magnetic electric motor comprising a second set of stator windings and the common rotor.

20. The system of claim 17 wherein the low voltage means comprises:

a first permanent-magnetic electric motor comprising a first set of stator windings;

a second permanent-magnetic electric motor comprising a second set of stator windings, the first and the second sets of stator windings being concentric to one another and wherein the first and the second permanent-magnet electric motors share a rotor common to both the first and the second permanent-magnetic electric motors.